

89.6; upper lake region, 89.5; Ohio valley and Tennessee, 87.9; upper Mississippi valley, 85.6; Missouri valley, 84.4; north Pacific coast region, 85.9; middle Pacific coast region, 85.7; south Pacific coast region, 96.1.

There were one hundred omissions to predict (twenty-three being due to the absence of reports from the Pacific coast,) out of 3,813, or 2.62 per cent. Of the 3,713 predictions that have been made, one hundred and fourteen, or 3.07 per cent., are considered to have entirely failed; one hundred and eighteen, or 3.18 per cent., were one-fourth verified; three hundred and twenty-nine, or 8.86 per cent., were one-half verified; three hundred and seventy-six, or 10.13 per cent., were three-fourths verified; 2,776, or 74.76 per cent., were verified, so far as can be ascertained from the tri-daily reports.

#### CAUTIONARY SIGNALS.

During December, 1882, one hundred and fifteen cautionary signals were displayed; of these, one hundred and one, or 87.83 per cent., were justified by winds of twenty-five miles per hour at or within one hundred miles of the station. Seventy-one cautionary off-shore signals were displayed; of these, sixty-six, or 92.96 per cent., were fully justified, both as to direction and velocity; three cautionary off-shore signals were justified as to velocity, but not as to direction. Four cautionary Northwest signals were ordered, all of which were justified as to direction, and one was justified as to direction and velocity. One hundred and ninety signals of all kinds were displayed, of which one hundred and sixty-eight, or 88.42 per cent., were fully justified. These do not include signals ordered at sixty-nine display stations, where the velocity is only estimated. Five signals were ordered late.

One hundred and sixty-six winds of twenty-five miles or more per hour were reported for which no signals were ordered; most of these were high local winds or strong sea-breezes.

#### NAVIGATION.

##### STAGE OF WATER IN RIVERS.

The highest and lowest stages of water observed at the Signal Service stations, during the month of December, 1882, are given in the table on the right-hand of chart iii. In the first column of this table are given the heights of water which have been found dangerous to property at the stations.

The Mississippi river was frozen as far south as Dubuque, Iowa, on the 8th, and remained closed during the remainder of the month. At Keokuk, Iowa, the river reached its highest point on the 31st, when it was within two feet and two inches of the danger-line. The lower Mississippi remained nearly stationary during the month, reaching its highest stage at Vicksburg, Mississippi on the 1st; at New Orleans, Louisiana, on the 5th, 6th, and 22d, and at Port Eads, Louisiana, on the 20th. At Saint Louis, Missouri, on the 18th, the river reached its lowest stage since November 29th, 1880, interrupting navigation, but rose on the 20th and 21st, when navigation was resumed. The Missouri river was highest at Leavenworth, Kansas, on the 19th; at Omaha, Nebraska, it was frozen from the 7th to the close of the month; and was frozen from the 2d to the close of the month at Yankton, Dakota. The Ohio river was highest at Cincinnati, Ohio, on the 29th, and at Louisville, Kentucky, on the 23d and 29th. At Pittsburgh, Pennsylvania, on the 11th, a special river report from New Geneva, Pennsylvania, was bulletined along the river front, stating a rise of five feet in the Monongahela river at that place. All vessels were loaded and prepared to depart as soon as the rise reached this point, and on the morning of the 12th, the river rose rapidly, permitting all of the boats to leave. The Cumberland river at Nashville, Tennessee, reached a height on the 3d and 4th sufficient to admit boats of heavy draught, and the winter steamboat season began on those dates. At Shreveport, Louisiana, on the 4th, work was suspended on the bridge across the Red River at that place on account of high water. On the 18th, the river fell rapidly, and on the 24th, work on the bridge was resumed. The Tennessee river at Chattanooga reached its lowest stage on the 9th and 10th, being unusually low for the season.

#### FLOODS.

Umatilla, Oregon, 14th.—Very heavy floods have occurred in the surrounding country. The town of Pendleton, Oregon, was flooded, and several buildings were carried away. Persons were compelled to climb trees to escape drowning. Several buildings on the Umatilla river were carried away, and wash-outs occurred along portions of the railroad, causing delay of trains. The damage done at Pendleton is estimated at \$250,000. On the 15th, the Willamette river rose three and one-half feet during twenty-four hours, reaching a higher point than ever known at this place.

Dayton, Washington Territory, 13th.—Touchet creek, which flows through this place, reached a higher point than it has touched for many years. No damage resulted in this vicinity other than the carrying away of fences and small bridges. Trains on the Oregon Railway and Navigation Company's railroad were discontinued owing to landslides, overflowed track, and damaged bridges. Nearly five inches of rain fell during the day, which is the heaviest rainfall of which there is any record at this place. The water in Touchet creek began falling at 5 a. m. of the 14th.

Lewiston, Idaho.—Very heavy rains fell during the 14th and 15th, the amount of rainfall being the largest ever known at this place. The Snake river rose about six feet and the Clearwater river rose four feet. Large quantities of drift were carried down the Snake river, making navigation dangerous. No damage resulted at this place.

Portland, Oregon.—Very heavy rain storm during the 12th and 13th. During the twenty-four hours ending at 8 p. m. of the 13th, 6.68 inches of rain fell. The storm ended during the night of the 13th. The river rose to seventeen feet and one inch above low-water mark, being a rise of ten feet and seven inches in forty-eight hours. Trains were delayed on the railroads on account of washing away of bridges, etc. The damage at this place was slight; a few small bridges were washed away and cellars filled with water. The rainfall during the storm was 12.83 inches.

#### HIGH TIDES.

Hatteras, North Carolina, 30th.

#### LOW TIDES.

New Haven, Connecticut, 8th.—The high westerly winds have caused remarkably low tides. Over the flats, where at high tide there is usually four feet of water, the ground is bare. Vessels are much inconvenienced by the low water.

#### ICE IN RIVERS AND HARBORS.

Mississippi river.—Saint Paul, Minnesota: floating ice in river on the 2d and 1th; river frozen from 7th to close of month. La Crosse, Wisconsin, floating ice, 2d, 3d; ferry boat "Warsaw" made last trip of season on 6th; river entirely frozen over on 8th.

Dubuque, Iowa.—Floating ice, 1st, 4th, 5th; ferry-boat forced down river a mile to effect landing on 6th; ferry-boat stopped running, and ice-dam above the railroad bridge on the 7th; river frozen over on 8th; teams crossing on ice, 11th; river rising, lifting ice and preventing teams from crossing on 21st; teams again crossing ice on 28th.

Davenport, Iowa.—Floating ice from 1st to 9th; ferry-boats stopped running, 6th; river closed at Le Claire, Iowa, on 7th; river frozen over, 10th; persons crossings on ice, 13th; teams crossing on ice, 15th; ice moving on rapids above the city, 21st. At 4.00 a. m. of the 22d, the ice in the river broke up below the bridge, crushing the platform of the Saint Louis and Saint Paul Packet Company's warehouse. The ferry-dock was broken from its moorings and carried one hundred yards down the river. The boat house belonging to the Davenport boat club was also damaged. Floating ice from 23d to 29th; teams crossing ice on the 30th and 31st.

Clinton, Iowa.—Floating ice, 3d; river frozen over, 7th.

Muscatine, Iowa.—River frozen over at Fairport, eight miles above this place on 7th; river frozen over at Muscatine, 24th.

Burlington, Iowa.—Floating ice, 3d; ferry-boats put into winter quarters, 6th; river frozen over, 15th.

**Keokuk, Iowa.**—The steamer "Minneapolis" (last boat of season) departed on the 4th; floating ice, 6th to 13th; ice-dam five miles below station, causing rapid rise on the 14th; river gorged at this place during morning of 15th; ice breaking up in river, 22d; ice-dam broke but formed again lower down the river on 23d.

**Saint Louis, Missouri.**—Ice forming rapidly in river on the 7th; floating ice from 10th to 13th, 15th to 18th, 24th, 29th, 31st; on the 18th, the river reached its lowest stage since November 29th, 1880; river rising, 20th; navigation resumed, 21st.

**Cairo, Illinois.**—Floating ice on the 8th and 9th, closing navigation northward on the latter date; river free of ice, 20th.

**Point Pleasant, Louisiana.**—Floating ice in river on the 11th.

**Ohio river.**—Portsmouth, Ohio: navigation suspended on account of floating ice from 16th to 20th; navigation resumed, 21st. Cincinnati, Ohio, floating ice, 8th, 16th to 20th.

**Vevay, Indiana:** river full of floating ice on 16th; ferry-boats crossing with great difficulty, and navigation generally suspended on the 18th.

**Louisville, Kentucky:** light ice running from 17th to 21st.

**Missouri river.**—Fort Bennett, Dakota: river frozen over on the 7th. Yankton, Dakota, river closed from the 2d, to the close of the month.

**Omaha, Nebraska:** river frozen over on the 7th.

**Leavenworth, Kansas:** slush ice running, 2d, 3d, 4th, 7th; river frozen along the shores compelling ferry-boats to stop running on the 7th; floating ice, 9th; river clear of ice, 12th; floating ice, 15th; ice-dam, 16th, 17th, 18th; ice-dam broke and navigation resumed during morning of the 19th; floating ice from 23d to 31st.

**Hudson river.**—Albany, New York: floating ice, 2d, 3d; the steamer "St. John," (last boat of season) departed, 3d; river frozen, navigation closed, 4th; navigation on canals officially closed, 7th. New York City, the steamer "Cayuga," left this port on the 7th, bound northward, but was compelled to return on account of ice. Reports from Poughkeepsie state that navigation is closed at all points north of that place. The steamers of the New York and Rondout Line, have stopped running; and for the first time in seven years, no boats are frozen in the ice. Ardenia, New York, river clear of ice and navigation unobstructed on the 12th.

**Lake Michigan.**—Chicago, Illinois: navigation closed, 7th; lake frozen, 8th.

**Lake Huron.**—Port Huron: Saint Clair river frozen over on 8th; navigation closed between this port and Detroit, but still open to Algonac on the 10th; the schooner "Tecumseh," (last boat of season) arrived from Georgian bay on 12th; Lake Saint Clair frozen over, 16th; floating ice in Saint Clair river, 17th, 18th.

**Lake Superior.**—Marquette, Michigan: harbor frozen over on the 8th; ice moved from around the docks on the 19th.

**Lake Ontario.**—Rochester, New York: the last schooner ("Great Western") cleared from the port of Charlotte, New York, on the 6th, bound to Port Hope, Ontario, and the last arrival (schooner "Rutherford") from Port Hope, on same date.

**Mackinac Straits.**—Mackinac City: slush ice along the shores of the straits on the 14th; straits frozen over with ice from one-half to two and one-half inches thick on 18th.

**Lake Erie.**—Cleveland, Ohio: lake filled with slush ice, 15th; frozen for a distance of one-fourth of a mile from the shore, 16th; ice ten inches thick, 18th; ice broke in lake, 24th.

**Presque Isle Bay.**—Erie, Pennsylvania: ice from ten to twelve inches thick in bay, 19th.

**Buffalo river.**—Buffalo, New York: river frozen over at this place on 8th; river frozen at mouth, 15th.

**Maquoketa river.**—Monticello, Iowa: river closed on the 6th, having been open two hundred and seventy-three days, being twenty-three days less than for 1881.

**Rock river.**—Rockford, Illinois: floating ice in river, 1st; river frozen over, 3d.

**Embarrass river.**—Charleston, Illinois: ice four inches thick

on 11th; six inches thick, 18th; ice broke and river rose eight feet, 22d.

**Bel river.**—Logansport, Indiana: during the morning of the 22d, the ice in the river broke up, being from eight to nine inches in thickness, and passed out without causing damage.

**Little Bay De Noquet.**—Escanaba, Michigan: last boat of season departed on 7th; bay frozen over, 10th; ice broke up during the morning of the 12; bay frozen over, 16th.

**Thunder Bay and Thunder Bay river.**—Alpena, Michigan: floating ice in river, 3d; river frozen over and bay partly frozen on the 8th; bay entirely frozen over, and navigation closed for season on the 10th.

**Grand river.**—Grand Haven, Michigan: Grand river frozen over 6th; river partly open, 12th; river closed, 16th; river open and free of ice, 21st.

**Cuyahoga river.**—Cleveland, Ohio: river frozen, but opened by tugs on the 7th; several vessels frozen in ice on western part of the lake on the 8th; navigation closed, 14th; ice broke in river, 24th.

**Maumee river.**—Toledo, Ohio: river covered with thin ice on the 3d; much ice in bay and floating in river, 4th; river frozen over and navigation closed, 7th; ice six inches thick in river on 9th.

**Sandusky bay.**—Sandusky, Ohio: ice in bay from one to one and a half inches thick, but was broken up by wind on 3d; the steamer "Jay Cook," and sailing vessel "Hattie Wells" (last boats of season), left this port on 6th. Bay froze over during night of 7th.

**Detroit river.**—Detroit, Michigan: a solid barrier of ice formed across the river near Amherstburg, Michigan, on the 9th, closing navigation; the schooner "Unadilla" was caught in the ice on Lake Erie and several other vessels were cut down by ice; the steamer "City of Detroit" could not return from Cleveland.

**Connecticut river.**—New Haven, Connecticut: navigation closed on 4th. New London, Connecticut, ice on ponds in vicinity, from six to thirteen inches in thickness, on 31st.

**Penobscot river.**—Bangor, Maine: river frozen over on 4th; river open, 6th; navigation closed, 8th.

**Susquehanna river.**—Catawissa, Pennsylvania: the north branch of the Susquehanna was closed by ice on the 8th, but opened gradually during the latter part of the month.

**Lake Champlain.**—Plattsburg, New York: very heavy ice in harbor and great difficulty experienced in making landings on the 20th.

**Alleghany and Monongahela rivers.**—Pittsburgh, Pennsylvania: during the early morning of the 24th, the ice broke in the Alleghany, a few miles above the junction, and came down with such force as to do great damage to property along the river banks. The Monongahela river was full of ice, and rose two feet from 1.00 to 3.00 p. m. No damage was done to steamboat property at this city, but the damage to lumber yards is estimated at \$16,000. Morgantown, West Virginia, floating ice in the Monongahela on the 8th, 9th, 18th, 19th, 20th.

**Des Moines river.**—Des Moines, Iowa: river frozen over on 6th.

**Yellowstone river.**—Terry's Landing, Montana: river frozen over on 28th.

**Erie canal.**—Rochester, New York: ice three inches thick, and five boats ice-bound between Syracuse and Rochester, on the 8th.

**Delaware and Raritan canal.**—Bordentown, New Jersey: canal closed by ice from 18th to 27th, inclusive.

#### TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors, at the Signal Service stations, and the average depth at which the observations were taken, are given in the table on the right-hand of chart ii. In the first column of the table, is given the maximum temperature observed during the month; and in the second column, the minimum temperature observed during the same period. Owing to ice formation, observations